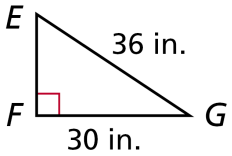
Attendance Problems. Solve for x.

1. $x^2 + 38 = 3x^2 - 12$

2. 137 + x = 180

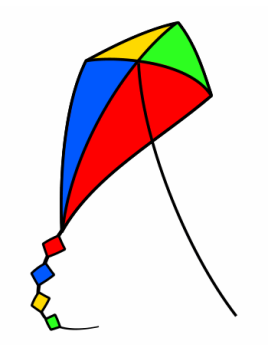
3. $42 = \frac{1}{4}(12 + x)$

4. Find the FE.

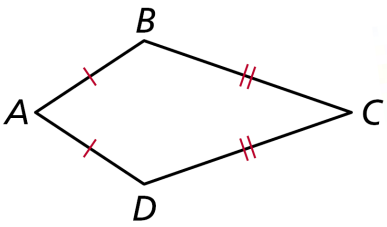


- I can use properties of kites to solve problems.
- I can use properties of trapezoids to solve problems.

Common Core: C.9-12.G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and prove relationships in geometric figures.

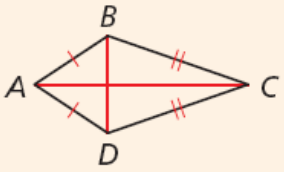
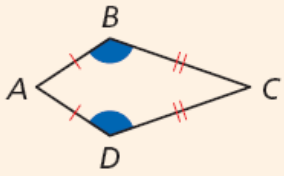


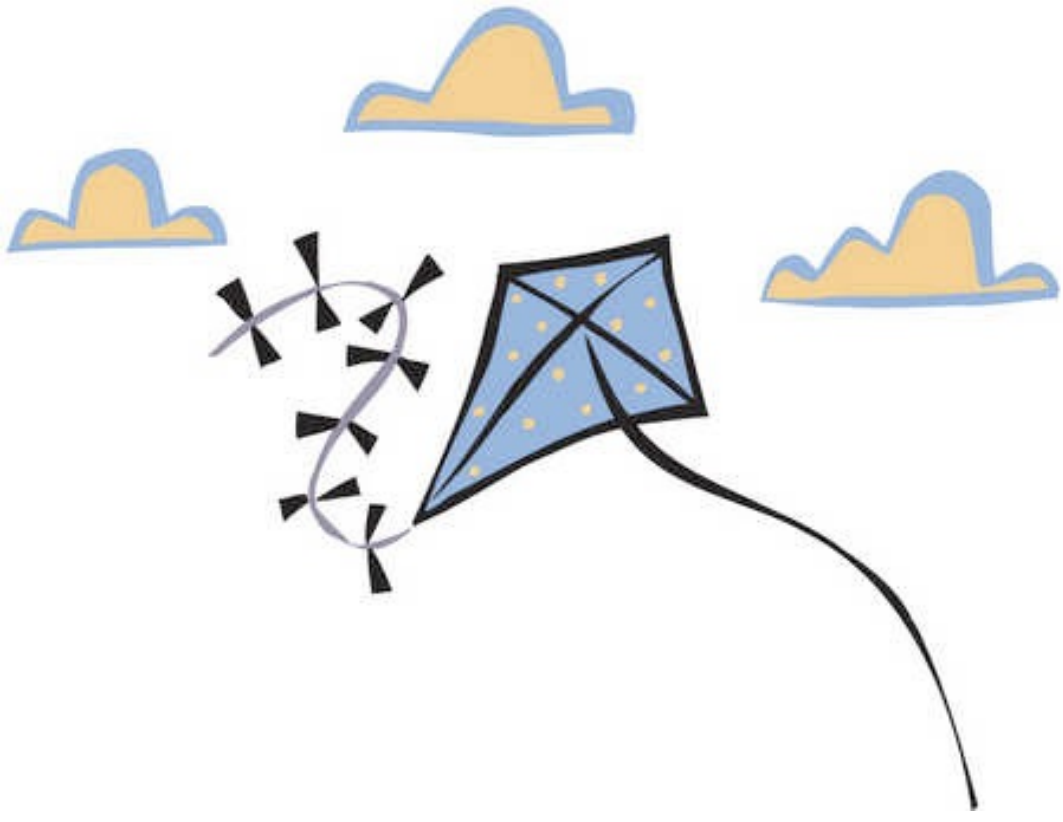
A **kite** is a quadrilateral with exactly two pairs of congruent consecutive sides.



Kite *ABCD*

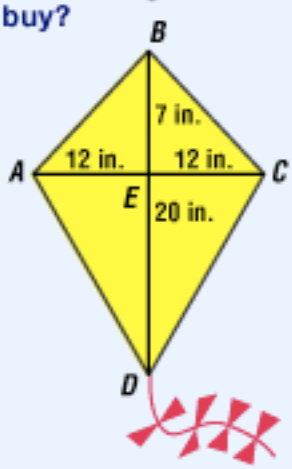
Theorems **Properties of Kites**

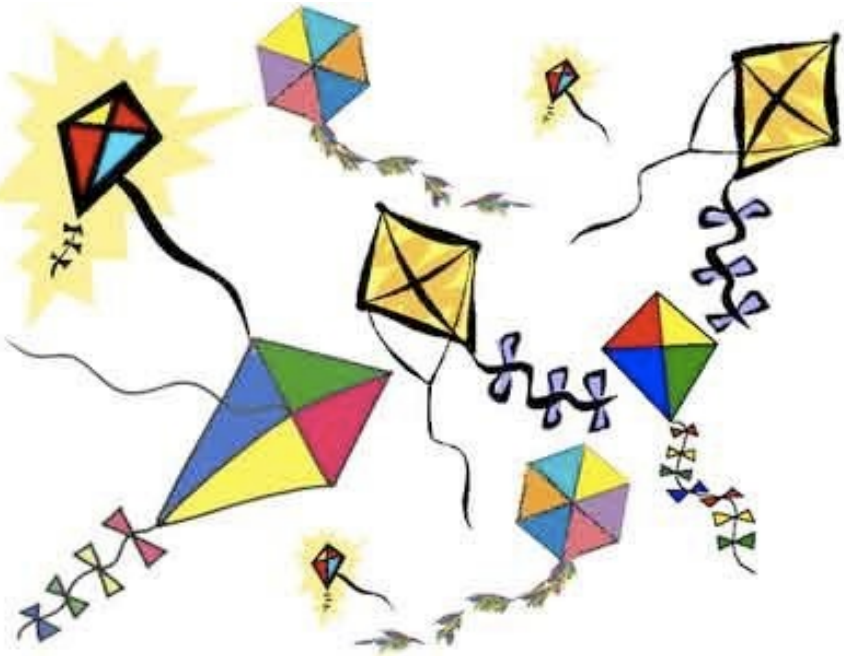
THEOREM	HYPOTHESIS	CONCLUSION
6-6-1 If a quadrilateral is a kite, then its diagonals are perpendicular. (kite → diags. ⊥)		$\overline{AC} \perp \overline{BD}$
6-6-2 If a quadrilateral is a kite, then exactly one pair of opposite angles are congruent. (kite → one pair opp. ∡ ≅)		$\angle B \cong \angle D$ $\angle A \ncong \angle C$



Refer to video example 1.

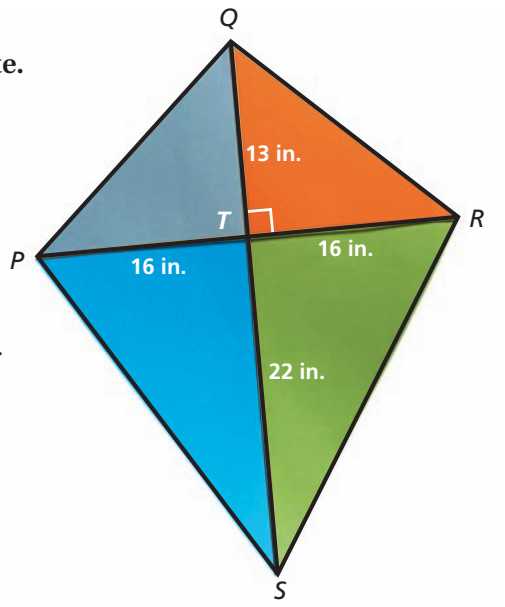
Alicia is using a pattern to make a kite and she must cover the outer edges with a cloth binding. There are 2 feet of binding in one package. What is the total amount of binding needed to cover the edges of the kite? How many packages of binding must Alicia buy?





1 Problem-Solving Application

Alicia is using a pattern to make a kite. She has made the frame of the kite by placing wooden sticks along the diagonals. She also has cut four triangular pieces of fabric and has attached them to the frame. To finish the kite, Alicia must cover the outer edges with a cloth binding. There are 2 yards of binding in one package. What is the total amount of binding needed to cover the edges of the kite? How many packages of binding must Alicia buy?



1 Understand the Problem

The **answer** has two parts.

- the total length of binding Alicia needs
- the number of packages of binding Alicia must buy

2 Make a Plan

The diagonals of a kite are perpendicular, so the four triangles are right triangles. Use the Pythagorean Theorem and the properties of kites to find the unknown side lengths. Add these lengths to find the perimeter of the kite.

3 Solve

$PQ = \sqrt{16^2 + 13^2}$ *Pyth. Thm.*
$= \sqrt{425} = 5\sqrt{17}$ in.

$RQ = PQ = 5\sqrt{17}$ in. $\overline{PQ} \cong \overline{RQ}$

$PS = \sqrt{16^2 + 22^2}$ *Pyth. Thm.*
$= \sqrt{740} = 2\sqrt{185}$ in.

$RS = PS = 2\sqrt{185}$ in. $\overline{RS} \cong \overline{PS}$

perimeter of $PQRS = 5\sqrt{17} + 5\sqrt{17} + 2\sqrt{185} + 2\sqrt{185} \approx 95.6$ in.

Alicia needs approximately 95.6 inches of binding.

One package of binding contains 2 yards, or 72 inches.

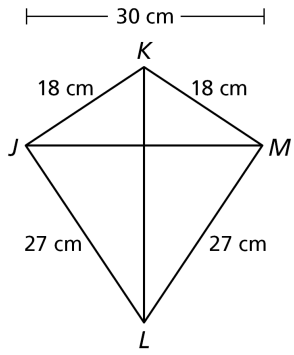
$\frac{95.6}{72} \approx 1.3$ packages of binding

In order to have enough, Alicia must buy 2 packages of binding.

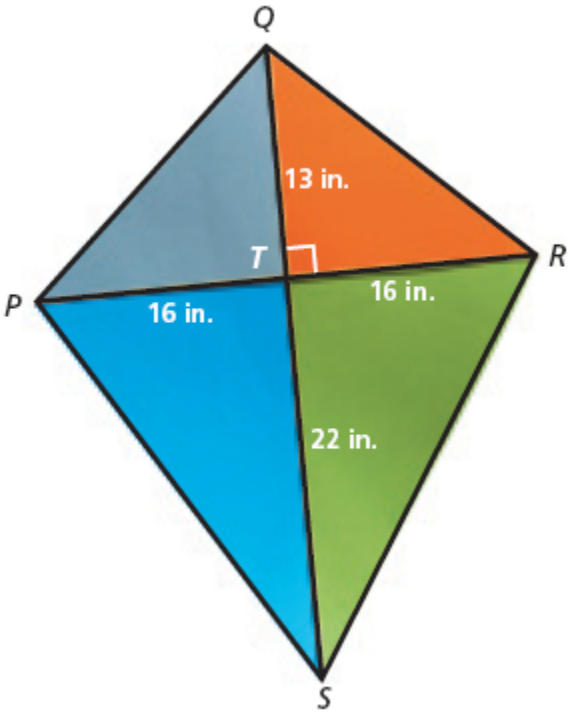
4 Look Back

To estimate the perimeter, change the side lengths into decimals and round. $5\sqrt{17} \approx 21$, and $2\sqrt{185} \approx 27$. The perimeter of the kite is approximately $2(21) + 2(27) = 96$. So 95.6 is a reasonable answer.

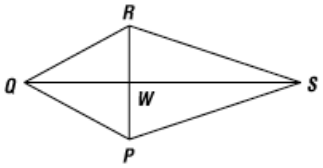
Example 1. Lucy is framing a kite with wooden dowels. She uses two dowels that measure 18 cm, one dowel that measures 30 cm, and two dowels that measure 27 cm. To complete the kite, she needs a dowel to place along $\overline{KL}$. She has a dowel that is 36 cm long. About how much wood will she have left after cutting the last dowel?



5. <u>Guided Practice</u>. Daryl is going to make a kite by doubling all the measures in the kite. What is the total amount of binding needed to cover the edges of his kite? How many packages of binding must Daryl buy?

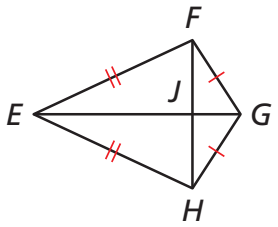


Refer to video Example 2. In kite PQRS,
$m\measuredangle RSW = 20° \;\&\; m\measuredangle RQW = 49°$. Find
$m\measuredangle WRS, m\measuredangle QPS, \& \; m\measuredangle QRW$.



2 Using Properties of Kites

In kite *EFGH*, $m\angle FEJ = 25°$, and $m\angle FGJ = 57°$. Find each measure.



A $m\angle GFJ$

$m\angle FJG = 90°$	*Kite → diags. ⊥*
$m\angle GFJ + m\angle FGJ = 90$	*Acute ∡s of rt. △ are comp.*
$m\angle GFJ + 57 = 90$	*Substitute 57 for m∠FGJ.*
$m\angle GFJ = 33°$	*Subtract 57 from both sides.*

B $m\angle JFE$

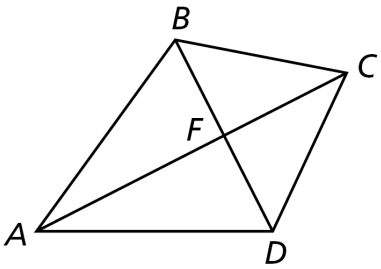
$\triangle FJE$ is also a right triangle, so $m\angle JFE + m\angle FEJ = 90°$. By substituting $25°$ for $m\angle FEJ$, you find that $m\angle JFE = 65°$.

C $m\angle GHE$

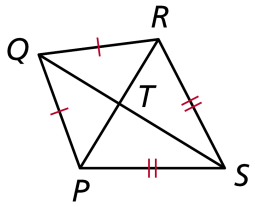
$\angle GHE \cong \angle GFE$	*Kite → one pair opp. ∡s ≅*
$m\angle GHE = m\angle GFE$	*Def. of ≅ ∡s*
$m\angle GFE = m\angle GFJ + m\angle JFE$	*∠ Add. Post.*
$m\angle GHE = 33° + 65° = 98°$	*Substitute.*

<u>Example 2</u>. In Kite ABCD, $m\measuredangle DAB = 54°$ & $m\measuredangle CDF = 52°$. Find the following measures.

A. $m\measuredangle BCD$ **B.** $m\measuredangle ABC$ **C.** $m\measuredangle FDA$



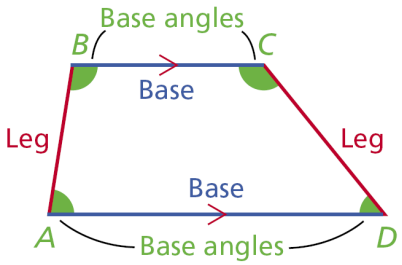
Guided Practice. In kite PQRS,
$m\angle PQR = 78°$ & $m\angle TRS = 59°$. **Find each measure.**



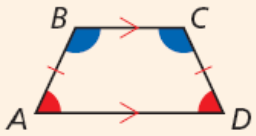
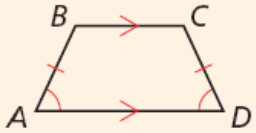
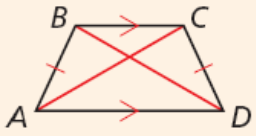
6. $m\angle QRT$ **7.** $m\angle QPS$

8. $m\angle PSR$

A **trapezoid** is a quadrilateral with exactly one pair of parallel sides. Each of the parallel sides is called a **base**. The nonparallel sides are called **legs**. **Base angles** of a trapezoid are two consecutive angles whose common side is a base. If the legs of a trapezoid are congruent, the trapezoid is an **isosceles trapezoid**.



Theorems Isosceles Trapezoids

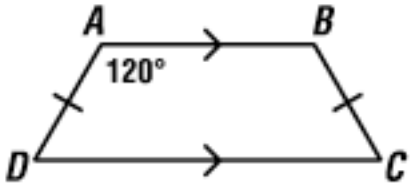
THEOREM	DIAGRAM	EXAMPLE
6-6-3 If a quadrilateral is an isosceles trapezoid, then each pair of base angles are congruent. (isosc. trap. → base ∡s ≅)		$\angle A \cong \angle D$ $\angle B \cong \angle C$
6-6-4 If a trapezoid has one pair of congruent base angles, then the trapezoid is isosceles. (trap. with pair base ∡s ≅ → isosc. trap.)		$ABCD$ is isosceles.
6-6-5 A trapezoid is isosceles if and only if its diagonals are congruent. (isosc. trap. ↔ diags. ≅)		$\overline{AC} \cong \overline{DB} \leftrightarrow$ $ABCD$ is isosceles.

Q: Do geometry teachers have any special talents?
A: I hear they can fly kites well.

Refer to video example 3.

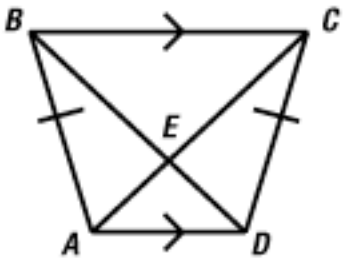
A.

Find m∠C.



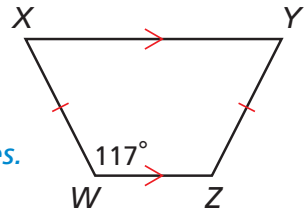
B.

AC = 12.7 and *BE* = 7.1. Find *ED*.



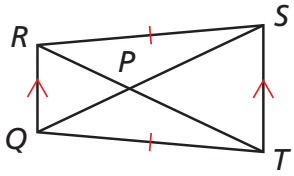
3 Using Properties of Isosceles Trapezoids

A **Find m∠*Y*.**



$m\angle W + m\angle X = 180°$	*Same-Side Int. ∡s Thm.*
$117 + m\angle X = 180$	*Substitute 117 for m∠W.*
$m\angle X = 63°$	*Subtract 117 from both sides.*
$\angle Y \cong \angle X$	*Isosc. trap. → base ∡s ≅*
$m\angle Y = m\angle X$	*Def. of ≅ ∡s*
$m\angle Y = 63°$	*Substitute 63 for m∠X.*

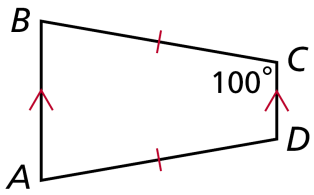
B ***RT* = 24.1, and *QP* = 9.6. Find *PS*.**



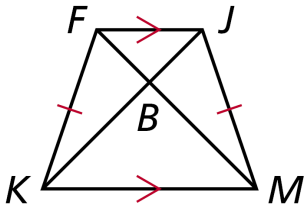
$\overline{QS} \cong \overline{RT}$	*Isosc. trap. → diags. ≅*
$QS = RT$	*Def. of ≅ segs.*
$QS = 24.1$	*Substitute 24.1 for RT.*
$QP + PS = QS$	*Seg. Add. Post.*
$9.6 + PS = 24.1$	*Substitute 9.6 for QP and 24.1 for QS.*
$PS = 14.5$	*Subtract 9.6 from both sides.*

Example 3.

A. Find $m\measuredangle A$.

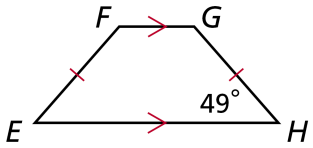


B. KB = 21.9 & MF = 32.7. Find FB.

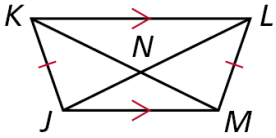


Guided Practice.

9. Find $m\measuredangle F$.



10. If JL = 10.6 & NL = 14.8, find KM.



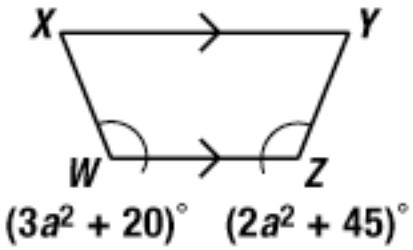
6-6 Properties of Kites and Trapezoids *(p 445)* 13, 14, 15, 17, 18.

"Based on what you know about him in history books, what do you think Abraham Lincoln would be doing if he were alive today? 1) Writing his memoirs of the Civil War. 2) Advising the President. 3) Desperately clawing at the inside of his coffin."
-- *David Letterman*

Refer to video example 4.

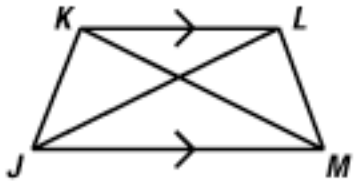
A.

Find the values of *a* so that *WXYZ* is isosceles.



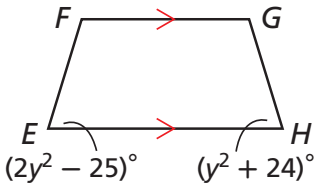
B.

JL = 6*x* + 3, and *KM* = 2*x* + 31. Find the value of *x* so that *JKLM* is isosceles.



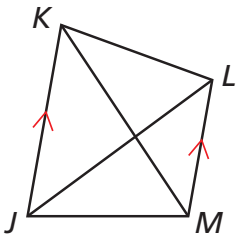
4 Applying Conditions for Isosceles Trapezoids

A **Find the value of y so that $EFGH$ is isosceles.**



$\angle E \cong \angle H$	*Trap. with pair base ∡s ≅ → isosc. trap.*
$m\angle E = m\angle H$	*Def. of ≅ ∡s*
$2y^2 - 25 = y^2 + 24$	*Substitute $2y^2 - 25$ for $m\angle E$ and $y^2 + 24$ for $m\angle H$.*
$y^2 = 49$	*Subtract y^2 from both sides and add 25 to both sides.*
$y = 7$ or $y = -7$	*Find the square root of both sides.*

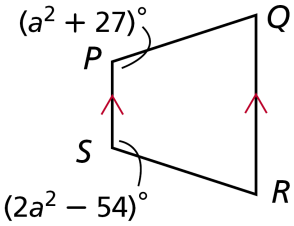
B **$JL = 5z + 3$, and $KM = 9z - 12$. Find the value of z so that $JKLM$ is isosceles.**



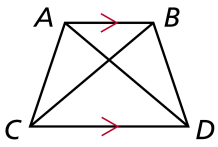
$\overline{JL} \cong \overline{KM}$	*Diags. ≅ → isosc. trap.*
$JL = KM$	*Def. of ≅ segs.*
$5z + 3 = 9z - 12$	*Substitute $5z + 3$ for JL and $9z - 12$ for KM.*
$15 = 4z$	*Subtract $5z$ from both sides and add 12 to both sides.*
$3.75 = z$	*Divide both sides by 4.*

Example 4.

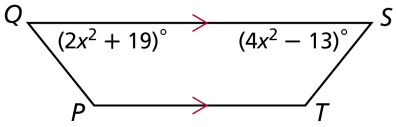
A. Find the value of a so that $PQRS$ is isosceles.



B. $AD = 12x - 11$, and $BC = 9x - 2$. Find the value of x so that $ABCD$ is isosceles.



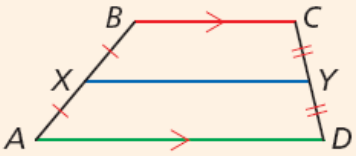
11. Guided Practice. Find the value of x so that $PQST$ is isosceles.



The **midsegment of a trapezoid** is the segment whose endpoints are the midpoints of the legs. In Lesson 5-1, you studied the Triangle Midsegment Theorem. The Trapezoid Midsegment Theorem is similar to it.

Theorem 6-6-6 **Trapezoid Midsegment Theorem**

The midsegment of a trapezoid is parallel to each base, and its length is one half the sum of the lengths of the bases.



$\overline{XY} \parallel \overline{BC}$, $\overline{XY} \parallel \overline{AD}$

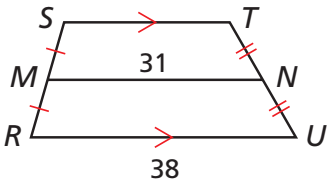
$XY = \frac{1}{2}(BC + AD)$

Refer to video example 5.

Find *ED*.

5 Finding Lengths Using Midsegments

Find *ST*.



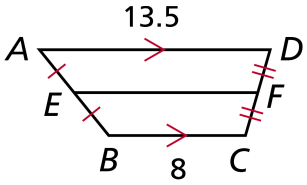
$MN = \frac{1}{2}(ST + RU)$ *Trap. Midsegment Thm.*

$31 = \frac{1}{2}(ST + 38)$ *Substitute the given values.*

$62 = ST + 38$ *Multiply both sides by 2.*

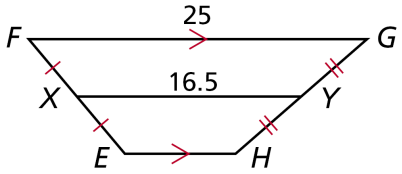
$24 = ST$ *Subtract 38 from both sides.*

Example 5. Find EF.



Guided Practice.

12. Find EH.



13. Construct a Venn diagram showing the relationship between the quadrilaterals.

6-6 Properties of Kites and Trapezoids

- *(p 445)* 13, 14, 15, 17-25, 33, 40, 42, 45.
- 6B Ready to Go On pretest and post-tests.